QUEEN CITY FORGING CO.
People who make the process work

Case Study

Queen City Forging Solutions in Silicon Iron **Enhanced Rail Relay Reliability with a 400% Boost in Productivity**

The Problem:

Critical signaling relays, large electromechanical switches used in train control systems, rely on the accuracy of dozens of components to function reliably over years of service under severe environmental conditions. With the advent of solid state electronics, applications using electromechanical devices for switching applications were considered obsolete. A solid state switch, having no moving mechanical components, was expected to be more reliable and less expensive than a mechanical contactor or relay. Based on this assumption, attention to electromechanical devices began to wane. Innovation and improvement in older designs was seen as unnecessary.

Although it was assumed electromechanical devices would soon be replaced by solid state electronics, several unexpected issues quickly challenged those beliefs. Electronic design changed rapidly, as solid state devices quickly evolved and were replaced by new and improved components. Systems designed as "state of the art" became obsolete in a few years; parts no longer available, technicians able to reprogram or repair obsolete designs nowhere to be found. Some systems covering hundreds of miles of right of way required complete, unplanned and very costly rebuilds.

It was also discovered that the new generation of electronics was highly vulnerable to lightning strikes to the rails, and even near misses that induced current in interconnected circuitry. The solid state switches could fail in both the "open" or "closed" condition rendering all related circuit logic unreliable—not an acceptable outcome with 8-10,000 tons of freight train and public safety on the line.

With a new appreciation for the robust design capabilities of the electromechanical critical relay, efforts to improve the manufacturing processes were begun to accomplish the following goals:

- Improve the ability to absorb current surges without the use of elaborate protection and suppression systems
- Provide redundancy of operation when all other devices have failed
- Failsafe operation: by resolving to the "open circuit" state when a lightning strike destroys even this last line of capability, assuring trains are signaled to stop and crossing gates would activate to close

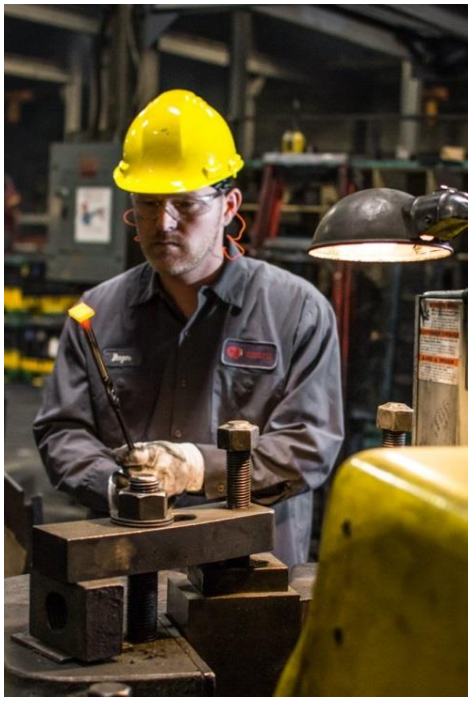
To provide years of reliable service, relay components must have low "magnetic remanence", meaning the electromagnetic properties of the metal must be nearly at zero value when no current flows to the electromagnetic coils. In other words, as non-magnetic as possible. The long-term reliability of the electromagnetic relay system requires that critical component materials and processes maintain the lowest remanence possible, and to resist any change as components "age" over the service life of the relay.

The challenge was to make the critical relay cheaper, faster, better, without sacrifice to quality. With nearly a dozen different parts in the electromagnetic circuit, dimensional accuracy to control "stack tolerance" was also critical to proper functioning of the product.

Queen City Forging's breadth of forging experience and expertise in a wide range of metallurgical solutions, allowed their team to provide the right manufacturing processes for improving the relay signaling system's reliability at a competitive cost . . .

The QC Forge Solution:

When the leading global manufacturer of the critical relay first came to QC Forge, it was seeking an improved method to produce the "core" of the relay. Special alloys were required for the components to have very low magnetic remanence. Queen City took on the challenge, not only to forge the alloy into components with greater dimensional accuracy than ever before, but to accomplish the unique heat treatments and testing of the components to assure all requirements were achieved.



Queen City Forging operator removes silicon iron relay component from machine after upset forging.

To accomplish this, QC Forge developed a comprehensive manufacturing and supply chain management process. Starting with a traditional material used in magnetic circuits, silicon iron, this involved sourcing specialized raw material and manufacturing components used for forging, stamping and machining of silicon iron forgings.

QC Forge performs special magnetic testing on critical relay components to confirm low "magnetic remanence" properties.

Experiments were conducted with different heat treating methods and results were measured with specialized production testing equipment to assure that each component met specific magnetic requirements, as dictated by the position in the electromagnetic circuit.

In addition to forging, stamping, heat treating and magnetic testing of components, QC Forge managed all secondary operations, including machining and plating for over a dozen critical components in a variety of sizes and configurations. This resulted in completed parts that were ready for assembly on the customer's line, supplied on a JIT basis through the customer's Kanban system.

QC Forge manages all secondary operations, including machining and plating.

The Results:

Through innovative processing and continuous management of a complex supply chain, QC Forge now provides a cost-competitive solution improving the reliability and consistency of the finished components. The customer has reported improved productivity in final assembly, increasing throughput from 80-90 to over 450-500 finished standard relays per shift.

The success of improving production for the primary core component lead to production of a family of components

for a series of similar critical relay designs. Improvements in dimensional and magnetic tolerances allowed the OEM to increase productivity as much as 5X in finished relay output, providing a significant competitive advantage while improving their bottom line.

Queen City's innovation and value-added approach allowed the customer to dramatically reduce and simplify their supply chain, while substantially enhancing the reliability of the electromagnetic relays and the critical safety of rail transportation, wherever the customer's rail system control products are used.

…a solution forged by innovation.

For more information:

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